D4

B5 Cont.

a luminescence conversion layer disposed directly on said semiconductor body and having a substantially constant thickness, said luminescence conversion layer containing a luminescent material, said luminescence conversion layer partially converting the blue light into yellow light, such that the semiconductor component emits white light including the blue light and the yellow light.--

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Remarks:

Reconsideration of the application is requested.

Claims 1-34 are now in the application. Claim 1 has been amended. Claim 34 has been added.

In item 2 on page 2 of the above-mentioned Office action, claims 1-12, 14-16, and 24-26 have been rejected as being unpatentable, over Tadatsu (JP 5-152609 A) in view of Geusic (U.S. Patent No. 3,593,055) under 35 U.S.C. § 103.

The rejection has been noted and claim 1 has been amended in an effort to even more clearly define the invention of the instant application. Support for the changes in claim 1 may e.g. be found on page 39, line 14 to page 40, line 5 in combination with Fig. 8. Fig. 8 clearly shows that a substantial portion of the radiation of the first wavelength

(blue light) passes through the conversion layer for forming (together with the yellow light) a polychromatic visible light.

Tadatsu discloses a resin dome shaped LED 4 encapsulating a light emitting body 11 disposed in a cavity positioned atop of a first terminal and electrically connected to the first and a second terminal via bonding wires. The encapsulation is filled with a fluorescent dye 5. The dye is excited by emissions from the emitter 11 to produce light. The dye is dispersed throughout the dome having a non-uniform thickness and thus the path lengths of the radiation through the dome have <u>different</u> lengths.

The Examiner stated that Geusic teaches a uniform layer 16 of fluorescent resin wherein the path length of photons passing through the layer have substantially the same path length.

It is noted that Geusic uses configurations that convert <u>essentially all</u> of the infrared emission originating in the infrared emitting diode into visible light. Col. 4, lines 21-22 of the patent to Geusic state that a multilayer dielectric coating is used which is <u>highly reflective at the infrared wavelenth</u> of the diode but is highly transparent to the visible wavelengths. Col. 5, lines 21-22 of the patent to Geusic state that the height of the phosphor section 31 is

chosen so as to yield a <u>substantially complete absorption</u> of the infrared emission.

Claim 1 has been amended to point out that the luminescence conversion element emits a substantial portion of the radiation of the first wavelength range and emits the radiation of the second wavelength range such that the semiconductor component emits polychromatic visible light.

Clearly, neither Tadatsu nor Geusic show or suggest the limitation of a luminescence conversion element being formed such that the radiation of the first wavelength range passes through the luminescence conversion element along a plurality of paths, the plurality of paths having a substantially equal path length inside the luminescence conversion element, and the luminescence conversion element emitting a substantial portion of the radiation of the first wavelength range and the radiation of the second wavelength range, as recited in claim 1. The subject matter of claim 1 is therefore patentable over a combination of Tadatsu and Geusic.

In item 3 on page 2 of the Office action, claims 1-33 have been rejected as being unpatentable over Tadatsu with Geusic and further in view of Mita (U.S. Patent No. 3,932,881) and Pinnow (U.S. Patent No. 3,691,482) under 35 U.S.C. § 103.

None of the references shows or suggests the limitation of a luminescence conversion element being formed such that the radiation of the first wavelength range passes through the luminescence conversion element along a plurality of paths, the plurality of paths having a substantially equal path length inside the luminescence conversion element, and the luminescence conversion element emitting a substantial portion of the radiation of the first wavelength range and the radiation of the second wavelength range as recited in claim 1.

As already explained in the response filed on January 24, 2000, Geusic discloses three embodiments of an LED. Each of these embodiments includes a phosphor layer for a <u>maximum absorption</u> of infrared radiation emitted by a pn junction source. The IR source is encapsulated and the phosphor layer is provided above or around an encapsulation. The encapsulation is dome shaped so as to provide a tangential incidence of the IR light upon the phosphor layer (see Fig. 1). For a maximum visible emission based on the absorption and total luminescence of the IR source, a minimum thickness of the phosphor layer is required, along considerations on how to form the dome. Where such a minimum thickness is not economical or practical, a second layer (see Fig. 2, reference numeral 15 and/or 23) may be coated on top of the phosphor layer. The second layer passes visible radiation while

absorbing or reflecting IR radiation (see col. 4, lines 46-63). Finally, a third embodiment takes further measures to address the problem of an incomplete total absorption of the IR radiation. Here, a dome shaped encapsulation of an IR source 33 passes IR radiation into a phosphor layer 31 housed in an internally reflecting housing 35. Not all of the IR radiation is absorbed by the phosphor layer, therefore a second dome 30 is placed on top of the housing 35 to effect an additional IR absorption while passing essentially only visible radiation and practically no infrared radiation.

Firstly, the device of Geusic is configured for an essentially <u>total</u> absorption of the source radiation by the luminescent layer. In contrast thereto, the invention of the instant application is intended for a passage of a <u>substantial</u> portion of the source radiation so as to combine it with the luminescent layer emission thereby producing a polychromatic visible radiation. Geusic teaches away from the configuration of amended claim 1, and clearly does not anticipate or make it obvious to provide the combination of features defined in claim 1. Second, Geusic teaches the use of one luminescent layer to absorb <u>essentially all</u> of the source radiation such that the total spectrum of the emission is produced by the luminescent layer, which is clearly different from the use of a combination of two different wavelength ranges, one of which passes through the luminescent layer.

The Examiner used Mita only for teaching "encapsulating layers with different luminescent properties with dome design" and "10 micron particle size which is effective as a diffusing agent". Mita discloses a structure that is similar to the structure of Geusic, namely, an encapsulated light source 34, 31 providing infrared emissions onto a phosphor layer 38 and the phosphor layer converting the IR emissions into visible light. A single large body 33 houses the phosphor layer and the encapsulation in an internally reflecting cavity 36 such that the phosphor layer receives a maximized amount of infrared radiation from the encapsulation and thus converts as much of the infrared radiation as possible (see col. 4, lines 25-50).

Pinnow is directed to a display system which uses combinations of phosphors which upon laser stimulation emit white light. The Examiner uses Pinnow to show the use of YAG:Ce phosphor. The configuration of Pinnow is completely different from an LED as defined in claim 1. In particular, the resulting light emission does not include laser light that <u>passes through</u> the phosphor screen 15, Pinnow only uses reflected laser light (col. 5, lines 67-70, col. 6, lines 30-35).

Clearly even a combination of the cited references cannot suggest the luminescence conversion element as defined in claim 1.

In item 5 on page 2 of the Office action, the Examiner rejected claims 1-4, 6-10, 13, 17, 21-23, 25, 26 and 28-33 as being unpatentable over Abe (U.S. Patent 5,535,230) under 35 USC § 103(a).

In particular, the Examiner stated that the phosphor layer 4 of Abe enables a constant path length for the photons.

Abe discloses two embodiments of a light source (see Figs. 1a and 1b). The first embodiment includes two semiconductor laser sources 1 mounted in a heat sink 2. The output from the lasers pass through a diffusing lens 3 en route to a fluophor 4. The fluophor is coated on the inside wall of a vacuum tube 5 which is charged with argon gas. The diffused laser light L1 excites the fluophor which produces the white light emission L. The laser light is not a component of the visible white light (see col. 4, lines 17-38). The second embodiment includes three semiconductor lasers IR, IG, IB whose light is also passed through a convergence lens 9, a collimator lens 8 and a diffusion lens 3. The combined output alone results in white light emission. In the second embodiment there is no fluophor or other luminescence element.

Clearly, Abe does not disclose a luminescence conversion element being formed such that the radiation of the first wavelength range passes through the luminescence conversion element along a plurality of paths, the plurality of paths having a substantially equal path length inside the luminescence conversion element, and the luminescence conversion element emitting a substantial portion of the radiation of the first wavelength range and the radiation of the second wavelength range, as recited in claim 1. In other words, Abe fails to teach or suggest the configuration as claimed wherein the first wavelength is from a radiation source and the second wavelength is emitted by a luminescent layer stimulated by the radiation source. Rather, Abe discloses a light source using a plurality of lasers which either emit themselves all the necessary components for white light emission or stimulate fluophor to create the entire white light emission with the fluophor. The subject matter of claim 1 is therefore also patentable over Abe.

New claim 34 is based on claim 1 and defines a white light emitting semiconductor component. The additional feature of the blue and yellow light is disclosed on page 39, lines 5-24 of the specification. The feature of the luminescence layer being disposed directly on the semiconductor body and having a substantially constant thickness is disclosed on page 7, line

20 to page 8, line 2 in combination with page 37, lines 5-8 of the specification.

With regard to new claim 34 it is noted that none of the prior art documents shows or suggests the limitation of a luminescence conversion element converting blue light into yellow light, such that the semiconductor component emits white light including the blue light and the yellow light, in combination with the limitation of the luminescence conversion layer being disposed directly on the semiconductor body and having a substantially constant thickness, as recited in claim 34.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1 or 34. Claims 1 and 34 are, therefore, believed to be patentable over the art and since all of the dependent claims are ultimately dependent on claim 1, they are believed to be patentable as well.

In view of the foregoing, reconsideration and allowance of claims 1-34 are solicited.

Petition for extension is herewith made. The extension fee for response within a period of two months pursuant to Section 1.136(a) is enclosed.

Please charge any other fees which might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

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For Applicants

MB:cgm

September 12, 2000

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